

Process Intensification Engineering For Efficiency Sustainability And Flexibility Isotopes In Organic Chemistry

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Process Integration and Intensification - Jirí Jaromír Kleměš
2014-05-26

"The authors have provided all the elements required for complete understanding of the basic concepts in heat recovery and water minimization in chemical and related processes, and followed these with carefully selected and developed problems and solutions in order to ensure that the concepts delivered can be applied." Simon Perry, The University of Manchester. This graduate textbook covers fundamentals of the key areas of Process Integration and Intensification for intra-process heat recovery (Heat Integration), inter-process heat recovery and cogeneration (Total Site) as well as water conservation. Step by step working sessions are illustrated for deeper understanding of the taught materials. The textbook also provides a wealth of pointers as well as further information for readers to acquire more extensive materials on the diverse industrial applications and the latest development trends in Process Integration and Intensification. It is addressed to graduate students as well as professionals to help the effectively application of

Process Integration and Intensification in plant design and operation.
Sustainable Development in the Process Industries - J. Harmsen
2011-11-30

The complete, hands-on guide to sustainable development Today's process industries must develop natural resources within an eco-friendly framework that balances current demand with future need. Realizing this goal necessitates global vigilance of three key areas—people, planet, and prosperity—known as the Triple Bottom Line or, simply, the Triple P. *Sustainable Development in the Process Industries* details how worldwide implementation of sustainable processes in present-day industries can positively influence the Triple P going forward by lowering poverty, reducing pollution, and conserving resources. This in-depth guide includes: Real-world case studies and examples Individual chapters written by industry experts Application in industries such as petroleum and fuel, food, recycling, mineral processing, and water processing Focus on the micro (molecules, unit operations, processes) to the macro (industrial sites, value chains, regions, the world) Providing lessons with

practical application rather than pure theory, Sustainable Development in the Process Industries offers sound solutions to social, ecological, and economic challenges imperative to assuring our planet's well-being for generations.

27th European Symposium on Computer Aided Process Engineering - 2017-09-21

27th European Symposium on Computer Aided Process Engineering, Volume 40 contains the papers presented at the 27th European Society of Computer-Aided Process Engineering (ESCAPE) event held in Barcelona, October 1-5, 2017. It is a valuable resource for chemical engineers, chemical process engineers, researchers in industry and academia, students, and consultants for chemical industries. Presents findings and discussions from the 27th European Society of Computer-Aided Process Engineering (ESCAPE) event

Introduction to Green Chemistry, Second Edition - Albert Matlack
2010-04-05

In the nearly 10 years since the publication of the bestselling first edition of Introduction to Green Chemistry, interest in green chemistry and clean processes has grown so much that topics, such as fluorinated biphasic catalysis, metal organic frameworks, and process intensification, barely mentioned in the first edition, have become major areas of research. In addition, government funding has ramped up the development of fuel cells and biofuels. It reflects the evolving focus from pollution remediation to pollution prevention. Copiously illustrated with over 800 figures, this second edition provides an update from the frontiers of the field. New and expanded research topics: Metal-organic frameworks Solid acids for alkylation of isobutene by butanes Carbon molecular sieves Mixed micro- and mesoporous solids Organocatalysis Process intensification and gas phase enzymatic reactions Hydrogen storage for fuel cells Reactive distillation Catalysts in action on an atomic scale Updated and expanded current events topics: Industry resistance to inherently safer chemistry Nuclear power Removal of mercury from vaccines Removal of mercury and lead from primary explosives Biofuels Uses for surplus glycerol New hard materials to reduce wear Electronic

waste Smart growth The book covers traditional green chemistry topics, including catalysis, benign solvents, and alternative feedstocks. It also discusses relevant but less frequently covered topics with chapters such as Chemistry of Longer Wear and Population and the Environment. This coverage highlights the importance of chemistry to everyday life and demonstrates the benefits the expanded exploitation of green chemistry can have for society.

The Fundamentals of Process Intensification - Andrzej Stankiewicz
2019-06-13

This advanced textbook covering the fundamentals and industry applications of process intensification (PI) discusses both the theoretical and conceptual basis of the discipline. Since interdisciplinarity is a key feature of PI, the material contained in the book reaches far beyond the classical area of chemical engineering. Developments in other relevant disciplines, such as chemistry, catalysis, energy technology, applied physics, electronics and materials science, are extensively described and discussed, while maintaining a chemical engineering perspective.

Divided into three major parts, the first introduces the PI principles in detail and illustrates them using practical examples. The second part is entirely devoted to fundamental approaches of PI in four domains: spatial, thermodynamic, functional and temporal. The third and final part explores the methodology for applying fundamental PI approaches in practice. As well as detailing technologies, the book focuses on safety, energy and environmental issues, giving guidance on how to incorporate PI in plant design and operation -- safely, efficiently and effectively.

Process Intensification Technologies for Green Chemistry - Kamelia Boodhoo
2013-01-03

The successful implementation of greener chemical processes relies not only on the development of more efficient catalysts for synthetic chemistry but also, and as importantly, on the development of reactor and separation technologies which can deliver enhanced processing performance in a safe, cost-effective and energy efficient manner. Process intensification has emerged as a promising field which can effectively tackle the challenges of significant process enhancement, whilst also

offering the potential to diminish the environmental impact presented by the chemical industry. Following an introduction to process intensification and the principles of green chemistry, this book presents a number of intensified technologies which have been researched and developed, including case studies to illustrate their application to green chemical processes. Topics covered include:

- Intensified reactor technologies: spinning disc reactors, microreactors, monolith reactors, oscillatory flow reactors, cavitation reactors
- Combined reactor/separator systems: membrane reactors, reactive distillation, reactive extraction, reactive absorption
- Membrane separations for green chemistry
- Industry relevance of process intensification, including economics and environmental impact, opportunities for energy saving, and practical considerations for industrial implementation.

Process Intensification for Green Chemistry is a valuable resource for practising engineers and chemists alike who are interested in applying intensified reactor and/or separator systems in a range of industries to achieve green chemistry principles.

21st European Symposium on Computer Aided Process Engineering - E. N. Pistikopoulos 2011-07-21

The European Symposium on Computer Aided Process Engineering (ESCAPE) series presents the latest innovations and achievements of leading professionals from the industrial and academic communities. The ESCAPE series serves as a forum for engineers, scientists, researchers, managers and students to present and discuss progress being made in the area of computer aided process engineering (CAPE). European industries large and small are bringing innovations into our lives, whether in the form of new technologies to address environmental problems, new products to make our homes more comfortable and energy efficient or new therapies to improve the health and well being of European citizens. Moreover, the European Industry needs to undertake research and technological initiatives in response to humanity's "Grand Challenges," described in the declaration of Lund, namely, Global Warming, Tightening Supplies of Energy, Water and Food, Ageing Societies, Public Health, Pandemics and Security. Thus, the Technical

Theme of ESCAPE 21 will be "Process Systems Approaches for Addressing Grand Challenges in Energy, Environment, Health, Bioprocessing & Nanotechnologies."

Process Engineering and Industrial Management - Jean-Pierre Dal Pont 2013-03-04

Process Engineering, the science and art of transforming raw materials and energy into a vast array of commercial materials, was conceived at the end of the 19th Century. Its history in the role of the Process Industries has been quite honorable, and techniques and products have contributed to improve health, welfare and quality of life. Today, industrial enterprises, which are still a major source of wealth, have to deal with new challenges in a global world. They need to reconsider their strategy taking into account environmental constraints, social requirements, profit, competition, and resource depletion. "Systems thinking" is a prerequisite from process development at the lab level to good project management. New manufacturing concepts have to be considered, taking into account LCA, supply chain management, recycling, plant flexibility, continuous development, process intensification and innovation. This book combines experience from academia and industry in the field of industrialization, i.e. in all processes involved in the conversion of research into successful operations. Enterprises are facing major challenges in a world of fierce competition and globalization. Process engineering techniques provide Process Industries with the necessary tools to cope with these issues. The chapters of this book give a new approach to the management of technology, projects and manufacturing. Contents Part 1: The Company as of Today 1. The Industrial Company: its Purpose, History, Context, and its Tomorrow?, Jean-Pierre Dal Pont. 2. The Two Modes of Operation of the Company - Operational and Entrepreneurial, Jean-Pierre Dal Pont. 3. The Strategic Management of the Company: Industrial Aspects, Jean-Pierre Dal Pont. Part 2: Process Development and Industrialization 4. Chemical Engineering and Process Engineering, Jean-Pierre Dal Pont. 5. Foundations of Process Industrialization, Jean-François Joly. 6. The Industrialization Process: Preliminary Projects, Jean-

Pierre Dal Pont and Michel Royer. 7. Lifecycle Analysis and Eco-Design: Innovation Tools for Sustainable Industrial Chemistry, Sylvain Caillol. 8. Methods for Design and Evaluation of Sustainable Processes and Industrial Systems, Catherine Azzaro-Pantel. 9. Project Management Techniques: Engineering, Jean-Pierre Dal Pont. Part 3: The Necessary Adaptation of the Company for the Future 10. Japanese Methods, Jean-Pierre Dal Pont. 11. Innovation in Chemical Engineering Industries, Oliver Potier and Mauricio Camargo. 12. The Place of Intensified Processes in the Plant of the Future, Laurent Falk. 13. Change Management, Jean-Pierre Dal Pont. 14. The Plant of the Future, Jean-Pierre Dal Pont.

Process Intensification - David Reay 2011-04-08

Process intensification (PI) is a chemical and process design approach that leads to substantially smaller, cleaner, safer and more energy-efficient process technology. A hot topic across the chemical and process industries, this is the first book to provide a practical working guide to understanding and developing successful PI solutions that deliver savings and efficiencies. It will appeal to engineers working with leading-edge process technologies and those involved in research and development of chemical, process, environmental, pharmaceutical, and bioscience systems. * Shows chemical and process engineers how to apply process intensification to their system, process or operation * A hard-working reference and user guide to the technology AND application of PI, covering fundamentals, industry applications, supplemented by a development and implementation guide * Leading author team, including Professor Colin Ramshaw, developer of the HiGee high-gravity distillation process at ICI, widely credited as the instigator of PI principles

Integrated Design and Simulation of Chemical Processes -

Alexandre C. Dimian 2014-09-18

This comprehensive work shows how to design and develop innovative, optimal and sustainable chemical processes by applying the principles of process systems engineering, leading to integrated sustainable processes with 'green' attributes. Generic systematic methods are employed,

supported by intensive use of computer simulation as a powerful tool for mastering the complexity of physical models. New to the second edition are chapters on product design and batch processes with applications in specialty chemicals, process intensification methods for designing compact equipment with high energetic efficiency, plantwide control for managing the key factors affecting the plant dynamics and operation, health, safety and environment issues, as well as sustainability analysis for achieving high environmental performance. All chapters are completely rewritten or have been revised. This new edition is suitable as teaching material for Chemical Process and Product Design courses for graduate MSc students, being compatible with academic requirements world-wide. The inclusion of the newest design methods will be of great value to professional chemical engineers. Systematic approach to developing innovative and sustainable chemical processes Presents generic principles of process simulation for analysis, creation and assessment Emphasis on sustainable development for the future of process industries

Beyond the Molecular Frontier - National Research Council 2003-03-19
Chemistry and chemical engineering have changed significantly in the last decade. They have broadened their scope "into biology, nanotechnology, materials science, computation, and advanced methods of process systems engineering and control" so much that the programs in most chemistry and chemical engineering departments now barely resemble the classical notion of chemistry. *Beyond the Molecular Frontier* brings together research, discovery, and invention across the entire spectrum of the chemical sciences "from fundamental, molecular-level chemistry to large-scale chemical processing technology. This reflects the way the field has evolved, the synergy at universities between research and education in chemistry and chemical engineering, and the way chemists and chemical engineers work together in industry. The astonishing developments in science and engineering during the 20th century have made it possible to dream of new goals that might previously have been considered unthinkable. This book identifies the key opportunities and challenges for the chemical sciences, from basic

research to societal needs and from terrorism defense to environmental protection, and it looks at the ways in which chemists and chemical engineers can work together to contribute to an improved future.

Measuring Progress Towards Sustainability - Subhas K. Sikdar
2016-11-21

This book is a state of the art treatise on what has been done so far on measuring sustainability for decision making. Contributions will appeal to engineers and scientists engaged in technology development, assessment, and verification. Researchers working on engineering sustainability are likely to get ideas for further research in quantifying sustainability for industrial systems. Concepts described can be applied across all scales, from process technology to global sustainability; and challenges and limitations are also addressed. Readers will discover important insights about simulation-based approaches to process design and quantitative measurement techniques of sustainability for business and technology systems. Most of the examples and case studies are from chemical enterprises but the methodologies presented could be applicable to any system for which quantitative data for indicators are available, and the choice of the set of indicators of sustainability are comprehensive.

Process Synthesis and Process Intensification - Ben-Guang Rong
2017-09-25

Process synthesis and process intensification are becoming state-of-the-art scientific fields that provide the methods and tools to improve process technologies in terms of high energy efficiency, low capital investment, low emissions, improved safety, and less hazardous byproducts to achieve sustainable products and processes. The book covers manufacturing processes from both fossil- and biomass-based feedstocks for graduate students.

Membrane Engineering - Enrico Drioli 2018-12-17

Modern membrane science and technology aids engineers in developing and designing more efficient and environmentally-friendly processes. The optimal material and membrane selection as well as applications in the many involved industries are provided. This work is the ideal

introduction for engineers working in membrane science and applications (wastewater, desalination, adsorption, and catalysis), process engineers in separation science, biologists and biochemists, environmental scientists, and most of all students. Its multidisciplinary approach also stimulates thinking of hybrid technologies for current and future life-saving applications (artificial organs, drug delivery).

Sustainable Process Integration and Intensification - Jirí Jaromír Klemeš 2018-04-23

In its second edition, Sustainable Process Integration and Intensification continues the presentation of fundamentals of key areas of both fields. Thoroughly updated and extended to include the latest developments, the reader also finds illustrated working sessions for deeper understanding of the taught materials. The book is addressed to graduate students as well as professionals to help the effectively application in plant design and operation.

Process Intensification and Integration for Sustainable Design - Dominic C. Y. Foo 2021-04-19

Presents comprehensive coverage of process intensification and integration for sustainable design, along with fundamental techniques and experiences from the industry. Drawing from fundamental techniques and recent industrial experiences, this book discusses the many developments in process intensification and integration and focuses on increasing sustainability via several overarching topics such as Sustainable Manufacturing, Energy Saving Technologies, and Resource Conservation and Pollution Prevention Techniques. Process Intensification and Integration for Sustainable Design starts discussions on: shale gas as an option for the production of chemicals and challenges for process intensification; the design and techno-economic analysis of separation units to handle feedstock variability in shale gas treatment; RO-PRO desalination; and techno-economic and environmental assessment of ultrathin polysulfone membranes for oxygen-enriched combustion. Next, it looks at process intensification of membrane-based systems for water, energy, and environment applications; the design of internally heat-integrated distillation column (HIDiC); and graphical

analysis and integration of heat exchanger networks with heat pumps. Decomposition and implementation of large-scale interplant heat integration is covered, as is the synthesis of combined heat and mass exchange networks (CHAMENs) with renewables. The book also covers optimization strategies for integrating and intensifying housing complexes; a sustainable biomass conversion process assessment; and more. Covers the many advances and changes in process intensification and integration Provides side-by-side discussions of fundamental techniques and recent industrial experiences to guide practitioners in their own processes Presents comprehensive coverage of topics relevant, among others, to the process industry, biorefineries, and plant energy management Offers insightful analysis and integration of reactor and heat exchanger network Looks at optimization of integrated water and multi-regenerator membrane systems involving multi-contaminants Process Intensification and Integration for Sustainable Design is an ideal book for process engineers, chemical engineers, engineering scientists, engineering consultants, and chemists.

11th International Symposium on Process Systems Engineering - PSE2012 - 2012-12-31

While the PSE community continues its focus on understanding, synthesizing, modeling, designing, simulating, analyzing, diagnosing, operating, controlling, managing, and optimizing a host of chemical and related industries using the systems approach, the boundaries of PSE research have expanded considerably over the years. While early PSE research was largely concerned with individual units and plants, the current research spans wide ranges of scales in size (molecules to processing units to plants to global multinational enterprises to global supply chain networks; biological cells to ecological webs) and time (instantaneous molecular interactions to months of plant operation to years of strategic planning). The changes and challenges brought about by increasing globalization and the the common global issues of energy, sustainability, and environment provide the motivation for the theme of PSE2012: Process Systems Engineering and Decision Support for the Flat World. Each theme includes an invited chapter based on the plenary

presentation by an eminent academic or industrial researcher Reports on the state-of-the-art advances in the various fields of process systems engineering Addresses common global problems and the research being done to solve them

Process Intensification - Fernando Israel Gómez-Castro 2019-10-21

Intensified processes have found widespread application in the chemical and petrochemical industries. The use of intensified systems allows for a reduction of operating costs and supports the “greening” of chemical processes. However, the design of intensified equipment requires special methodologies. This book describes the fundamentals and applications of these design methods, making it a valuable resource for use in both industry and academia.

Process Intensification in Chemical Engineering - Juan Gabriel Segovia-Hernández 2016-04-02

This book will provide researchers and graduate students with an overview of the recent developments and applications of process intensification in chemical engineering. It will also allow the readers to apply the available intensification techniques to their processes and specific problems. The content of this book can be readily adopted as part of special courses on process control, design, optimization and modelling aimed at senior undergraduate and graduate students. This book will be a useful resource for researchers in process system engineering as well as for practitioners interested in applying process intensification approaches to real-life problems in chemical engineering and related areas.

Sustainable Development in Chemical Engineering - Vincenzo Piemonte 2013-05-28

Sustainable development is an area that has world-wide appeal, from developed industrialized countries to the developing world. Development of innovative technologies to achieve sustainability is being addressed by many European countries, the USA and also China and India. The need for chemical processes to be safe, compact, flexible, energy efficient, and environmentally benign and conducive to the rapid commercialization of new products poses new challenges for chemical engineers. This book

examines the newest technologies for sustainable development in chemical engineering, through careful analysis of the technical aspects, and discussion of the possible fields of industrial development. The book is broad in its coverage, and is divided into four sections: Energy Production, covering renewable energies, innovative solar technologies, cogeneration plants, and smart grids; Process Intensification, describing why it is important in the chemical and petrochemical industry, the engineering approach, and nanoparticles as a smart technology for bioremediation; Bio-based Platform Chemicals, including the production of bioethanol and biodiesel, bioplastics production and biodegradability, and biosurfactants; and Soil and Water Remediation, covering water management and re-use, and soil remediation technologies. Throughout the book there are case studies and examples of industrial processes in practice.

Process Intensification - Mirko Skiborowski 2022-06-06

Process intensification aims for increasing efficiency and sustainability of (bio-)chemical production processes. This book presents strategies for the intensification of fluid separation processes such as reactive distillation, reactive absorption and membrane assisted separations. The authors discuss theoretical fundamentals, model development, methods for synthesis and the design as well as scale-up and industrial process applications.

Process Intensification - Jan Harmsen 2020-07-20

Process Intensification is a comprehensive textbook and treats the theory of process intensification design, and all innovation steps from idea generation to commercial implementation, and all focused on contributing to the UN Sustainable Development Goals. This book covers the 'hard' elements of design, modelling, and experimental validations and the 'soft' elements, values of engineers, interests of stakeholders and beliefs of society.

Process Intensification Technologies for Biodiesel Production - Anton Alexandru Kiss 2014-03-15

This book is among the first to address the novel process intensification technologies for biodiesel production, in particular the integrated

reactive separations. It provides a comprehensive overview illustrated with many industrially relevant examples of novel reactive separation processes used in the production of biodiesel (e.g. fatty acid alkyl esters): reactive distillation, reactive absorption, reactive extraction, membrane reactors, and centrifugal contact separators. Readers will also learn about the working principles, design and control of integrated processes, while also getting a relevant and modern overview of the process intensification opportunities for biodiesel synthesis. Biodiesel is a biodegradable and renewable fuel that currently enjoys much attention. In spite of the recent advances, the existing biodiesel processes still suffer from problems associated with the use of homogeneous catalysts (e.g. salt waste streams) and the key limitations imposed by the chemical reaction equilibrium, thus leading to severe economic and environmental penalties. The integration of reaction and separation into one operating unit overcomes equilibrium limitations and provides key benefits such as low capital investment and operating costs. Many of these processes can be further enhanced by heat-integration and powered by heterogeneous catalysts, to eliminate all conventional catalyst related operations, using the raw materials efficiently and the reaction volume, while offering high conversion and selectivity, and significant energy savings. The targeted audience of this book includes both academia (students and researchers) and industry (project leaders, technology managers, researchers, biodiesel producers, and equipment suppliers).

22nd European Symposium on Computer Aided Process Engineering - David Bogle 2012-08-03

Computer aided process engineering (CAPE) plays a key design and operations role in the process industries. This conference features presentations by CAPE specialists and addresses strategic planning, supply chain issues and the increasingly important area of sustainability audits. Experts collectively highlight the need for CAPE practitioners to embrace the three components of sustainable development: environmental, social and economic progress and the role of systematic and sophisticated CAPE tools in delivering these goals. Contributions from the international community of researchers and engineers using

computing-based methods in process engineering Review of the latest developments in process systems engineering Emphasis on a systems approach in tackling industrial and societal grand challenges

Improvements in Bio-Based Building Blocks Production Through Process Intensification and Sustainability Concepts - Juan Gabriel Segovia-Hernandez 2021-10-01

Improvements in Bio-Based Building Blocks Production Through Process Intensification and Sustainability Concepts discusses new information on the production and cost of bio-based building blocks. From a technical point-of-view, almost all industrial materials made from fossil resources can be substituted using bio-based counterparts. However, the cost of bio-based production in many cases exceeds the cost of petrochemical production. In addition, new products must be proven to perform at least as good as their petrochemical equivalents, have a lower environmental impact, meet consumer demand for environmentally-friendly products, factor in population growth, and account for limited supplies of non-renewables. This book outlines the application of process intensification techniques which allow for the generation of clean, efficient and economical processes for bio-based chemical blocks production. Includes synthesis and process design strategies for intensified processes Describes multi-objective optimization applied to the production of bio-based building blocks Presents the controllability of processes where the production of bio-based building blocks is involved Provides examples using aspen and MATLAB Introduces several sustainable indexes to evaluate production processes Presents process intensification techniques to improve performance in productive processes

Process Intensification - Fernando Israel Gómez-Castro 2019-10-21
Intensified processes have found widespread application in the chemical and petrochemical industries. The use of intensified systems allows for a reduction of operating costs and supports the "greening" of chemical processes. However, the design of intensified equipment requires special methodologies. This book describes the fundamentals and applications of these design methods, making it a valuable resource for use in both industry and academia.

Process Intensification for Sustainable Energy Conversion - Fausto Gallucci 2015-05-18

This book addresses the application of process intensification to sustainable energy production, combining two very topical subject areas. Due to the increasing process of petroleum, sustainable energy production technologies must be developed, for example bioenergy, blue energy, chemical looping combustion, concepts for CO₂ capture etc. Process intensification offers significant competitive advantages, because it provides more efficient processes, leading to outstanding cost reduction, increased productivity and more environment-friendly processes.

Sustainable Industrial Chemistry - Fabrizio Cavani 2009-09-22

In recent years the need for sustainable process design and alternative reaction routes to reduce industry's impact on the environment has gained vital importance. The book begins with a general overview of new trends in designing industrial chemical processes which are environmentally friendly and economically feasible. Specific examples written by experts from industry cover the possibilities of running industrial chemical processes in a sustainable manner and provide an up-to-date insight into the main concerns, e.g., the use of renewable raw materials, the use of alternative energy sources in chemical processes, the design of intrinsically safe processes, microreactor and integrated reaction/ separation technologies, process intensification, waste reduction, new catalytic routes and/or solvent and process optimization.

Sustainability in the Process Industry: Integration and Optimization - Jiri Klemes 2010-09-22

Improve the energy efficiency of process industry practices Sustainability in the Process Industry explains process integration and optimization and discusses applications for improving the energy and water efficiency of industrial as well as nonindustrial energy users. Approaches for adapting these methodologies to include the integration of waste and renewable energy sources are covered. This authoritative text contains eight industrial-based case studies and nine testing examples with developed solutions. Details on software tools are also included in this practical

guide. Optimization goals and application areas within sustainable industrial process design and integration Formulating sustainable tasks as optimization problems Improving energy efficiency through process integration Heat exchange and heat recovery Water/mass integration Minimizing water use and efficient generation New, relevant process integration research results Process optimization frameworks, including mathematical programming and P-graph and S-graph frameworks Applications of process integration, modeling, and optimization software tools

Environmental Sustainability and Industries - Pardeep Singh 2022-06-17
Environmental Sustainability and Industries identifies and discusses critical areas related to environmentally conscious industrial development of products and services that may support more sustainable and equitable societies. This book addresses pollution prevention by referring to the use of processes, practices, and materials that reduce or eliminate the generation of pollutants at the source of production, more efficient use of raw materials, energy, water or other resources, or by conserving natural resources by maintaining clean production. It explains industrial energy efficiency as the most cost-effective use of energy in manufacturing processes, reducing its wastage as well as the total consumption of primary energy resources. Life cycle assessment is used as an analytical method to quantify environmental impacts, focusing on environmental considerations concerning process design and optimization, and including various sustainable manufacturing parameters in the context of industrial processes and proposes a classification of identified parameters to evaluate and optimize the manufacturing performances. The book also dives into industrial ecology, investigating how, where, and why environmental improvements can be made to develop a sustainable industry, meeting the needs of current generations without sacrificing the needs of the future ones. This book analyzes a company's environmental, social, and economic performance and their interrelationships, emphasizing the importance of identifying and understanding causal relationships between alternative approaches to action and their impact on financial and nonfinancial performance. It

concludes with a view on the future of sustainable industrial systems stressing change as a joint effort of scientists, governments, people in business, and academicians. Offers compiled information on the environmental sustainability for industry Provides principles and advanced trends and approaches for environmental sustainability for the industrial sector Discusses established and emerging technologies and processes for sustainable approaches for industry Presents the development in the use of the assessment models as a tool to support the research and applications of different sustainable technologies and processes

Reactive and Membrane-Assisted Separations - Philip Lutze
2016-07-28

Process intensification aims for increasing efficiency and sustainability of (bio-)chemical production processes. This book presents strategies for improving fluid separation such as reactive distillation, reactive absorption and membrane assisted separations. The authors discuss computer simulation, model development, methodological approaches for synthesis and the design and scale-up of final industrial processes.

Process Intensification - David Reay 2013-06-05

Process Intensification: Engineering for Efficiency, Sustainability and Flexibility is the first book to provide a practical working guide to understanding process intensification (PI) and developing successful PI solutions and applications in chemical process, civil, environmental, energy, pharmaceutical, biological, and biochemical systems. Process intensification is a chemical and process design approach that leads to substantially smaller, cleaner, safer, and more energy efficient process technology. It improves process flexibility, product quality, speed to market and inherent safety, with a reduced environmental footprint. This book represents a valuable resource for engineers working with leading-edge process technologies, and those involved research and development of chemical, process, environmental, pharmaceutical, and bioscience systems. No other reference covers both the technology and application of PI, addressing fundamentals, industry applications, and including a development and implementation guide Covers hot and high growth

topics, including emission prevention, sustainable design, and pinch analysis World-class authors: Colin Ramshaw pioneered PI at ICI and is widely credited as the father of the technology

Re-Engineering the Chemical Processing Plant - Andrzej Stankiewicz 2018-12-14

The first guide to compile current research and frontline developments in the science of process intensification (PI), *Re-Engineering the Chemical Processing Plant* illustrates the design, integration, and application of PI principles and structures for the development and optimization of chemical and industrial plants. This volume updates professionals on emerging PI equipment and methodologies to promote technological advances and operational efficacy in chemical, biochemical, and engineering environments and presents clear examples illustrating the implementation and application of specific process-intensifying equipment and methods in various commercial arenas.

Microstructured Devices for Chemical Processing - Madhvanand N. Kashid 2014-12-22

Faster, cheaper and environmentally friendly, these are the criteria for designing new reactions and this is the challenge faced by many chemical engineers today. Based on courses taught by the authors, this advanced textbook discusses opportunities for carrying out reactions on an industrial level in a technically controllable, sustainable, cost-effective and safe manner. Adopting a practical approach, it describes how miniaturized devices (mixers, reactors, heat exchangers, and separators) are used successfully for process intensification, focusing on the engineering aspects of microstructured devices, such as their design and main characteristics for homogeneous and multiphase reactions. It addresses the conditions under which microstructured devices are beneficial, how they should be designed, and how such devices can be integrated in an existing chemical process. Case studies show how the knowledge gained can be applied for particular processes. The textbook is essential for master and doctoral students, as well as for professional chemists and chemical engineers working in this area.

Intensification of Sorption Processes - Mahmood Reza Rahimi

2021-11-23

Intensification of Sorption Processes: Active and Passive Mechanisms introduces a number of selected, advanced topics in sorption processes/process intensification, covering both theoretical and applicable aspects. The first part of the book is devoted to the study of sorption processes based on active mechanisms, including ultrasonic, microwave, high-gravity, electrical and magnetic fields, while the second part covers passive mechanisms like nanostructures and nanofluids, membrane, supercritical fluids and sorption processes based on geometry design and equipment structure. The focus of the book is on key aspects of novel process intensification technologies (processes and equipment), i.e., absorption and adsorption, working principles, and design and applications. Covers all developments in the field of active and passive mechanisms for sorption processes Introduces basic principles of any intensified sorption process, along with details of equipment Evaluates industrial upscaling, economic evaluation/justification, future opportunities and challenges for each sorption process

Reactive Separation for Process Intensification and Sustainability - Carlos Ariel Cardona Alzate 2019-12-20

This book describes, analyses and discusses the main principles, phenomena and design strategies of reactive separation processes with an emphasis on the intensification as a basis of the sustainability. Different reactive separation processes are explained in detail to show the phenomena and with the purpose of understanding when their use allows advantages based on the output results. Case examples are analysed and the perspective of these processes in the future is discussed. The overall sustainability of reactive separation processes in the industry is also explained separately.

Advances in Legumes for Sustainable Intensification - Ram Swaroop Meena 2022-07-15

Advances in Legume-based Agroecosystem for Sustainable Intensification explores current research and future strategies for ensuring capacity growth and socioeconomic improvement through the utilization of

legume crop cultivation and production in the achievement of sustainability development goals (SDGs). Sections cover the role of legumes in addressing issues of food security, improving nitrogen in the environment, environmental sustainability, economic-environmentally optimized systems, the importance and impact of nitrogen, organic production, and biomass potential, legume production, biology, breeding improvement, cropping systems, and the use of legumes for eco-friendly weed management. This book is an important resource for scientists, researchers and advanced students interested in championing the effective utilization of legumes for agronomic and ecological benefit. Focuses on opportunities for agricultural impact and sustainability Presents insights into both agricultural sustainability and eco-intensification Includes the impact of legume production on societal impacts such as health and wealth management

Novel Process Windows - Volker Hessel 2015-03-23

This book introduces the concept of novel process windows, focusing on cost improvements, safety, energy and eco-efficiency throughout each step of the process. The first part presents the new reactor and process-related technologies, introducing the potential and benefit analysis. The core of the book details scenarios for unusual parameter sets and the new holistic and systemic approach to processing, while the final part analyses the implications for green and cost-efficient processing. With its practical approach, this is invaluable reading for those working in the pharmaceutical, fine chemicals, fuels and oils industries.

Process Intensification - David Reay 2008-08-22

Process intensification (PI) leads to a substantially smaller, cleaner, safer and more energy efficient process technology. For example, the scale reduction made possible by using high gravity fields to separate liquids has seen the reduction of distillation columns from 75m to a four of five metres in height in some areas. PI is a hot topic in chemical and process engineering - and beyond - and is now reaching a maturity that is seeing PI concepts applied to a wide range of processes and technologies. This

is the first book to provide a practical working guide to understanding PI and developing successful PI solutions and applications. By demonstrating the broad application of PI this book will be of value to audiences looking to take current technologies into new process areas as well as those looking to further its use in the chemical engineering sector. As well as detailing technologies and practical applications the book focusses on safety, energy and environmental issues, giving guidance on how to incorporate PI in plant design and operation safely, efficiently and effectively. This book provides up to date access to the best current information on PI, both through the world-class experience of the authors and by pinpointing other significant sources of data, equipment and expertise. * Shows chemical and process engineers how to apply process intensification (PI) to their product, process or production line * A hard-working reference and user guide to the technology AND application of PI, covering fundamentals, industry applications, and supplemented by a development and implementation guide * Leading author team, including Professor Colin Ramshaw, developer of the HiGee high gravity distillation process at ICI, who is widely credited as the father of PI

Intensification of Liquid-Liquid Processes - Laurence R. Weatherley 2020-04-16

Explore and review novel techniques for intensifying transport and reaction in liquid-liquid and related systems with this essential toolkit. Topics include discussion of the principles of process intensification, the nexus between process intensification and sustainable engineering, and the fundamentals of liquid-liquid contacting, from an expert with over forty-five years' experience in the field. Providing promising directions for investment and for new research in process intensification, in addition to a unique review of the fundamentals of the topic, this book is the perfect guide for senior undergraduate students, graduate students, developers, and research staff in chemical engineering and biochemical engineering.